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A Study on the Educational Use of Statistical Package for the Social Sciences

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ABSTRACT. *This study was performed to suggest the effective utilization of statistical package for educational research.More specifically, This study was approached in a perspective of two direction. The one is the testing, the other is the prediction. In a viewpoint of the teaching effect testing, this study is focused on the 'Post Hoc' and 'Planned Contrasts'. In a angle of our current living, this study is placed on the index, the quotient, and multiple analysis. In a critical point of future education, this study is put more emphasis on the factor analysis, time series analysis, the casual relationship, the behavioral analysis, the development of alternative model, a realistic possibility analysis of alternative future, estimation of factor in changing, hypothesis testing, the stability testing of system.Not only the literature review was used in this study, but also workshop articles and the results of discussion on the educational issue in the world future society.The result of this study is expected to help setting of the future oriented research direction, finding the needs of the more new statistical techniques.*

KEYWORDS: *Futurology, Educational Statistics, Structure Equation Model, Multiple Response, Post Hoc, Contrasts*

1. Introduction

1.1 The necessity and purpose of research

We are now living in the fourth industrial revolution society. Big Data is inextricably linked with the Fourth Industrial Revolution. The ability to extract valuable information and analyze data is becoming important in the reality of having to live with tens of billions of big data. The Fourth Industrial Revolution Society is making a big difference in our lives, and changes in society will affect our job structure. The World Economic Forum (2016) predicts a sharp drop in jobs in the fields of business, administration, manufacturing and production by 2020 and a significant increase in jobs in business, financial, management, and computer and math. In addition, Mc Kinsey & Company reports that data analytics experts in the

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United States are expected to be 140,000 to 190,000 in 2021, and 1.5 million managers will be able to make data-driven decisions. We expect the demand for professionals involved in processing and analysis of big data to grow in the future, which requires a change in awareness of the importance and need of Big Data analytics technologies at the national level. Since changes in society and the work district group inevitably affect the direction of education, our educational paradigm should also be changed, and should be nurtured in intelligence information capacity, a key competence in the Fourth Industrial Revolution society.

The importance of statistical analysis is growing in the field of education. In education, which is generally developing with the trend of social science statistics, the center of gravity of statistical use is shifting from verification to prediction. Verification statistics are often referred to as predictive statistics when trying to verify past events or social phenomena based on historical data, to use historical data to predict future possibilities.

Therefore, in order to effectively spread it to the educational field in accordance with social changes and the increasing demands for the use of statistical programs, it is necessary to explore ways of educational use in-depth analysis of the needs of education subjects. The purpose of this paper is to explore the teaching program of statistical analysis software represented by SPSS, which is applicable to the field of social science education.

2.2 Content of research

(1) To find ways to utilize the response and case ratio of Multiple Response in education.

(2) The method of educational use of the pre- and post-mortem verification methods is devised in the random analysis.

(3) Through consideration of the concept, background, merits and characteristics of the integrated approach used to explain causality of phenomena or issues that are occurring at the educational site, we seek educational use measures.

(4) Explore the types of techniques that study the future and complex uses, and consider what ways to increase the likelihood of success of forecasting.

2. Educational Use of Percentage and Verification Statistics

2.1 Multiple Response Analysis and Percentage

Multiple responses are techniques used to analyze inspection tools designed to enable more than one response to a single question: Categories that let you enter only the selected variable values, and selective ones that differentiate between choices. It is also known as a relatively simple yet reliable method of analyzing the various needs of those surveyed in depth. However, it was not until recently widely

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used due to limitations in coding and statistical processing procedures, but in recent years it has become easy to use with the development of statistical programs.

In particular, in the case of Categories, the choice may be limited by considering the order, or the number of choices may be limited without considering the order. If the sequence is considered, the use of weight cases should be used, If only two inspection tools are to be selected in consideration of the sequence, the number of cases in general is adjusted by multiplying the first position by two and the second rank by one. However, if such cases are deemed too large, researchers can adjust them to 1.5 times the first rank and 1 times the second rank on the basis of logical justification.

The results of the multiple response analysis show that two new percentages are presented. Response percentage means the ratio of the number of responses to the option when the total number of responses is 100. The percentage of cases means the percentage of responses to the option when the number of people who participated in the survey is 100.

If a new curriculum is to be developed in the field of education, teachers, students, and parents can be utilized to obtain in-depth analysis results, and it can also be used to establish education plans and determine important policies.

Therefore, the percentage used in education is as follows: Percentage English words have the meaning of '/cent' or '/100'. In other words, when the reference quantity in the ratio is taken as 100, the number of percent of the comparison is shown and the symbol uses '%'. Percent is a simple concept, but its usefulness is very high. Percent is used primarily to clarify the relative size of two or more numbers. First, if you make a reference number of 100 and then change the other number to a number of ratios to 100, you can compare the relative sizes at a glance, even within a limited range, even if they are different or heterogeneous.

However, many percentile data are intended for public deliberation, which is expressed in percentage points (%P). If a percentage with the same standard is directly compared over time, it may be added or subtracted with a normal number, the difference between the two percentages is called 'percentage point'.

In summary, the percentage is either the ratio or the rate of change. And the percentage point is the percentage change in the amount expressed as a percentage. For example, if a baseball hitter enters the ninth batter's box and hits three times, his batting average is "3/9=0.333..." However, the percentage is characterized by multiplying these probability values by 100 and always setting the criterion as 100.

An example of a percentage is the rate of price rise. For example, at the end of 2017, suppose that prices rose by 5% at the end of 2018, and increased by 6% at the end of 2019 compared with the end of 2018. 5% and 6% can be called the "price rise rate", and the difference of 1% can be "1% p" To describe; can be interpreted as "the price increase rate in 2019 increased by 1 percentage point compared to the 2018 price increase rate."

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2.2 A priori and a posteriori of variable analysis

ANOVA(ANalysis Of VAriances) is a general term for the methods used to verify differences between averages when there are more than three groups to compare. In this case, the independent variable of the input analysis must be the nominal scale, and the dependent variable must be the interval or ratio scale of the fractional variable. Based on an independent variable composed of three or more groups, the analysis method used to verify the mean difference of a dependent variable is called "one-way ANOVA". When more than two independent variables are input to verify the average difference of a dependent variable, it is called "multiple ANOVA".

The formula used for verification uses the F value calculated by dividing the intergroup variation by the variation within each group. However, this F value only validates the significant difference between groups, and it is not known specifically which group and group there are significant differences. Therefore, post-verification techniques are generally used to identify differences between these groups.

In general, it is difficult to be confident of the difference in mean between groups before analyzing the data. For that reason, a large number of post-verification methods are used, but if there is confidence in the difference in mean between groups, the Planned Contrasts method may be used.

(1)Educational Application of Post-Verification Method

During the verification process of the hypothesis, researchers need to proceed in a way to reduce type I error (α). However, reducing the probability of type I error increases the likelihood of falling into type II error (β), resulting in lower verification power (1- β) corresponding to confidence in the verification results. Therefore, this regard in determining how after-the-fact screening need to take into account.

LSD (the last-significant difference) performs T-verification of the mean values of all groups, but does not reduce the likelihood of type I error. Bonferroni and Tukey verification are strong in error control but somewhat weak in verification. While Bonferroni's verification power is higher than Tukey's when the number of groups to be compared, Tukey has an advantage over the larger Rock Bonferroni. Tukey is also generally more qualified than Scheffe or Dunnett.

'Q of R-E-G-W' stands for 'Ryan-Einot-Gabriel-Welsch' not only for good verification, but also for good control of Type I errors. However, it is not recommended to use a different number of examples of groups to be compared.

The formula to be used for post-verification is determined by the difference in the number of cases for the groups to be compared, whether the population is equally distributed, and whether normal distribution can be assumed. While relatively good verification results can be expected if the deviation is small, it is difficult to expect good results if the parent variance is different or if the number of cases differs between groups.

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'Hochberg GT2' and 'Gabriel' were designed to be used when there were differences in the number of cases in comparison groups, both of which were generally better validated but were similar when the number of cases was significantly different. In addition, 'Hochberg GT2' should not be used for data that is considered difficult to assume equal variances in the population.

For these reasons, there are formulas designed for use where it is difficult to assume equal variances in the population, such as 'T2 in Tamhane', 'T3 in Dunnett', 'Games-Howell' and 'Dunnett's C"Tamhane's T2' is a generally well-informed verification method, and 'Dunnett's T3' and 'Dunnett's C' have very good control of the first-class error. 'Games-Howell' is a very good method of verification if the sample size is large enough and the intergroup sample size differs greatly.

In sum, if a group with equal variances can be assumed and wants to perform post-mortem on a group with the same sample size, use the formula "Q" (R-E-G-W)and "Tukey" with good control over and verification of Type I errors, use 'Bonronferi' to increase control of Type I errors, and in case there is a slight difference in the sample size. The use of the 'Games-Howell' formula is recommended if it is deemed difficult to assume equal variances.

(2)Educational Application of planned comparison

If a researcher has sufficient knowledge and theoretical background for the research being pursued, the method of performing statistical verification with only intergroup preparedness of his interest is called the Planned Comparison assay.

There are two ways to compare. One is the group comparison method of "one-to-one" called pairwise comparisons, and the other is the group comparison method of "one-to-one," called complex comparisons. Assuming that (Table 1) uses three teaching methods, A, B, and C, and then pre-sections are performed in the process of conducting a random analysis to verify their effectiveness, P1, P2, P3 corresponds to a pair comparison, and C1, C2, and C3 are composite bridges.

There are two ways to compare. One is a "1 to 1" collective comparison method called "pairwise comparison", and the other is a "1 to many" collective comparison method called "complex comparison" . (Table 1) Use three teaching methods A, B, and C to conduct experimental research. In order to verify the effect, perform ex-ante analysis in the process of variable analysis, then P1, P2, and P3 are equivalent to the comparison between them. C1 , C2, C3 is equivalent to compound comparison.

All contrast coefficients should be added to zero. Therefore, three combinations of 1, -1, and 0 can be made in a even comparison, and if you take the contrast coefficient C1 of a composite comparison, the purpose of the preliminary comparison verification is to prepare for [Professor Law (A)] versus [Professor Law (B)+Professor Method (C)]. The comparison coefficient is then calculated as the ratio of the number of cases in [Professor Law (A)] to the number of cases in [Professor Law (B)+Professor Method (C)], and added to them all, it is zero (1-14/30-16/30=0).

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Table 1 Case of Contrast Coefficients for planned comparison

Comparison group		The teaching method A	The teaching method B	The teaching method C
Test variables		10	13	15
Case number		20	14	16
Pairwise comparison	Comparing coefficient P1	1	-1	0
	Comparing coefficient P2	1	0	-1
	Comparing coefficient P3	0	1	-1
Complex comparison	Comparing coefficient C1	1	-14/30	-16/30
	Comparing coefficient C1	-20/36	1	-16/36
	Comparing coefficient C1	-20/34	-14/34	1

If none of the six contrast coefficients given in <Table 3> are zero, omnibus hypothesis, which is set to zero, will be rejected and the study will accept that at least one contrast will not be zero.

3. Educational application of future prediction methods

3.1 Trends in statistical analysis

A brief look at the latest trends in the statistical program shows that although previously occurring techniques such as verification of hypotheses and based on ANOVA have been mainstream until now, from a few years ago, the Predictive Analysis (Predicted Analysis) technique has been reinforced. The Social Science Statistical Package (SPSS), developed for social science research, was given the new name PASW (Predictive Analysis Software) after being acquired by IBM, and gradually expanded its use to the natural sciences and applications. However, considering the user's awareness, the name was restored to IBM SPSS.

3.2 The Significance of Future Research Methods

The ultimate purpose of studying the future is to explore and create a predictable future, and to test and validate it, so that individuals, institutions, countries and international organizations can make the smartest decisions for the future, along with warnings. More specifically, you can use your personal successful workplace life, the ability to respond to change, your ability to choose your future, the ability to make decisions, to guide the future of your children and young people, to prevent

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disasters, to seize opportunities, and to understand modern society Promote self-esteem, expand one's range of activities, etc. as the significance of future research.

These future studies have several philosophical premises: First, we do not know the future, but we can measure the possible range of the future ahead of us, and secondly, the possibilities and conditions of the future can be changed by policy, which is predictable in making such policy decisions.Third, just as the sunrise can be predicted accurately rather than the main index, prospects and possibilities for the future are also predictable at any rate if approached in phases, and fourth, cross-validating in two or more ways can be more predictable than the single approach used to predict the future.Finally, humans are more interested in future prospects than in past experiences.

3.3 Success Factors for Forecasting the Future

(1) Increase the level of understanding of decision makers or leaders in future research methods.

(2) Decision makers, experts in the organization and futurologists jointly pursue research.

(3)If the decision maker lacks sufficient knowledge and understanding of the contentious issues, it must have efforts and will to overcome them.

(4)Subjective alternatives that may be of practical help to decision makers should not be daunted by claims for objectivity.

(5)Members of the research team should consist of people with a variety of areas of interest and experts on the status of issues.

(6)Decisions should be made on the basis of the information gathered.

(7)At least one study method that can be applied to the overall process of the issues under study needs to be utilized.

(8)Clarify to the decision maker the economic benefits expected from implementing the alternative.

(9)Clearly present viable technologies and alternatives for decision makers to overcome the fear of success.

(10)It presents a variety of clear and accurate alternatives for decision makers to choose from a political, social, and cultural perspective that aligns with their goals and strategies.

(11)Provide knowledge to overcome distrust that it will be impossible to realize. Knowledge at this time refers to the actual specific examples that have been found in the surrounding institutions or countries.

(12)If there is any information or data that is inaccurate, unreliable, or potentially confusing, then present a clear alternative.

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(13)Focus is placed on creating alternatives to overcome stereotypes through links to similar corporate and national situations at home and abroad.

3.4 Types of future research methods

Categorizing the methods employed by futurists in future research from a quantitative, qualitative, prescriptive, and experimental perspective is shown in Table 2. Among them are Future Polygon, Scenarios, State of the Future Index and Real-Time Delphi, Environmental Scanning, Futures Wheel, Cross Impact Analysis, etc.

Emerging Issues Analysis (EIA) was first introduced by Graham Moliter in 1977 and recently compiled by Dr. Seo Yong-seok of the University of Hawaii. The EIA takes advantage of its prediction that many of the existing problems and conflicts could provide information about the future that is feasible, starting from the assumption that they did not exist at any point in the past, and at the same time providing a reflective framework for interpreting the various assumptions that have been established in the past. So EIA is a technique that studies the early generation of issues, and these patterns typically appear in the form of logistic distributions in the form of a S-curve.

Trend analysis focuses on something that has already emerged and is going on. It's been a long time since it first appeared, but it's called trend analysis to capture the issue before it becomes a universal or universal issue. As such, the TIA focuses on predictable history or development processes, while the EIA focuses on issues that have just begun to arise. Thus the emerging issue develops into a trend, and this trend has already been started and taken over by someone, and if it is high-tech, it must be patented or paid a penalty with. On the other hand, the emerging issue has no owner, so if I preoccupy it, I can have a patent and receive a proper royalty. This is why emerging issues are more important in the economic sector than in the trend. However, compared with the view of Confucian classics, from the perspective of futurology, EIA contains the more important significance of the starting point of research.

Table 2 Types of future research methods

Method	Quantitative	Qualitative	Normative	Exploratory
Agent Modeling		X		X
Causal Layered Analysis		X		X
Chaos and Non-Linear Systems	X			X
Cross-Impact Analysis	X			X
Decision Modeling	X			X
Delphi Techniques		X	X	X
Econometrics and Statistical Modeling	X			X
Environmental Scanning		X		X
Field Anomaly Relaxation		X		X

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Futures Polygon	X	X	X	X
Futures Wheel		X	X	X
Genius Forecasting, Vision, and Intuition		X	X	X
Interactive Scenarios		X	X	X
Morphological Analysis		X	X	
Multiple Perspective		X	X	X
Participatory Methods		X	X	
Prediction Markets	X		X	
Relevance Trees		X	X	
Robust Decisionmaking	X			X
Scenarios	X	X	X	X
Science and Technology Roadmapping	X	X	X	X
Simulation-Gaming		X		X
State of the Future Index	X	X	X	X
Structural Analysis	X	X		X
Substitution Analysis				
Systems Modeling	X			X
Technological Sequence Analysis		X	X	
Text Mining		X	X	X
Trend Impact Analysis	X			X
Visioning		X	X	
Wild Cards	X	X		X

Jerome C. Glenn Theodore J. Gordon(2010). Future Research Methodology Ver. 3.0. The Millenium Project e-Book, p.10.

4. Conclusion

The proportion of indices in our lives is increasing. Many of these indices on the news, such as the Price Index, Stock Price Index, Exchange Rate Index, Unemployment Index, Discomfort Index, Consumer Attitude Index, Travel Index, and Ultraviolet Index, embody our lives as an indicator. The education sector is no exception Intelligence index, sensitivity index, moral index, multi-intelligence index, happiness index, stress index, window composition index, obesity index, standard score, percent score, etc.

The index is used in English in various ways, such as index, indicator, quotient, Z-score, Probability, and percentage. However, there is not much interest in the fact that these indices are based on probabilities and percentages.

In addition, it will not be long before a highly civilized society passes by a singularity. The human race is running toward a world where the long and long time passed and countless events and inventions are doubled in less than a year. Perhaps that is why it is not unusual to analyze the psychological needs of mankind. Therefore, the ability to develop multi-response type inspection tools and process statistics easily is expected to evolve in order to analyze individual in-depth needs for psychological testing or learning.

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In addition, from a philosophical point of view, the term education implies the concept of the 'future'. Therefore, education should always be the future, not the past. And going into the educational scene, as long as schools exist, efforts to measure learning effects and improve conditions based on them will continue. Therefore, it is necessary to consider statistical methods to verify the learning effects.

In conclusion, statistical use in education can be summarized into verification and prediction through in-depth analysis techniques based on an overall understanding and insight into the index. It is expected that the concepts presented in this paper will have a reasonable and positive effect on the various decisions taking place at the educational site.

References

[1] Andy Field (2014). Discovering Statistics using SPSS (3rd. Ed.) California; SAGE Publication Inc.
[2] Grell Jan M.(1992). Issue Analysis As An Extension of Environmental Scanning.Futures Research Quarterly, vol.8, no.2, p.83.
[3] Huss William R.(1988). A Move Toward Scenario Analysis. International Journal of Forecasting, vol.4, no.3.
[4] Biji Rob(1992). Delphi in a Future Scenario Study on Mental Health and Mental Health Care, Futures, vol.2, no.3.
[5] Mitchel Vincent-Wayne(1992). Using Delphi to Forecast New Technology Industries. Marketing Intelligence and Planning, vol.10, no.2.
[6] Nancy L. Leech, Karen C. Barrett, George A. Morgan(2008). SPSS for Intermediate Statistics (3rd Ed.). New York; Psychology Press.
[7] Timothy C. Mack(ed.)(2011). World Future 2011 - Moving from Vision to Action. World Future Society.